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Methods used in Iowa to fulfill industrial arts objectives

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METHODS USED IN IOWA TO

FULFILL INDUSTRIAL ARTS OBJECTIVES

by

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INTRODUCTION

An instructional method refers to a procedure of teaching to attain learning goals. Every teacher, regardless of his training, has some set goals and a method for reaching these goals. This study is concerned with the methods that Iowa industrial arts teachers use to meet instructional goals.

Industrial arts is unique with respect to many areas of education in that it can utilize many instructional methods for meeting its goals. Some of these methods are:

1. Laboratory or project methods.
2. Discussion-conference methods.
3. Lectures.
4. Self-instructional materials.
5. Field trips.
6. Demonstrations.
7. Audio-visual materials.
8. Resource people from industry.
9. Cooperative work experience programs.

A study of this list reveals that the industrial arts instructor is faced with the problem of selecting the best method for achieving his intended goal.

So often it is easy to get in a rut and use the same method over and over to meet many goals. This is not to say that a method can not be repeated, but many times some methods are discarded because they involve more work and planning.

The purposes of this study were threefold, they were: (1) to determine what methods are used by Iowa industrial arts teachers, (2) to determine what affects selection of teachers' methods, and (3) what new or innovative methods teachers are using to meet their objectives.

Objectives

The objectives for this study were:

1. To determine what methods Iowa industrial arts teachers use to meet instructional objectives.
2. To determine what importance Iowa industrial arts teachers place on instructional methods.
3. To determine if instructional method selection was influenced by number of years teaching experience.
4. To determine if instructional method selection was influenced by the amount of undergraduate training in industrial arts.
5. To determine if instructional method selection was influenced by the teaching area of emphasis.
6. To determine if instructional method selection was influenced by the grade level of the teaching assignment.
7. To determine if instructional method selection was influenced by the size of the school system.
8. To determine what new or innovative methods Iowa industrial arts teachers are using to meet instructional objectives.

REVIEW OF LITERATURE

To date there has been very little research concerning methods used to achieve industrial arts objectives. Most of the literature that is available is concerned with teachers and authorities rating the importance of each industrial arts objective.

Talkington (11) compared the Q-sort responses of industrial arts teachers in Colorado with the Q-sort responses of 35 selected prominent persons in industrial arts. His main objective was to determine whether there was unity of direction as to the priority of industrial arts objectives on a state and national level. The sortings of the Colorado teachers were further studied for agreement and disagreement by grouping into the following six catagories:

1. Years of teaching experience.
2. Professional preparation.
3. Major or minor in industrial arts.
4. Presence or absence of industrial arts in their own public school education.
5. Industrial arts subject area that constitutes majority of teaching assignment.
6. The grade level of industrial arts teaching assignment.

In an attempt to describe the industrial arts programs in the public secondary schools of Iowa, Hahn (2) found that many schools offer programs in electricity-electronics and power mechanics, but woodworking and drafting still predominate in total time alloted. Hahn also found that industrial arts teachers methods consisted mainly of teacher demonstrations, lectures, and projects in the laboratory. Field trips and community resources were seldom used.

Very little material related to research in industrial arts objectives was reported by Sommers and Face (10). They indicated the need for a consensus as to those objectives which may be considered important to industrial arts. Sommers and Face also said:

> Until there are precise clear statements of the objectives for industrial arts, it will be extremely difficult for researchers to study and test the attainment of these objectives.

They expressed a need to evaluate industrial arts in terms of its own objectives.

In examining the objectives of industrial arts with respect to certain selected sociological factors of contemporary American society, Miller (8) found that industrial arts education had no clear set of original objectives. Instead on the national level, it accepted those published by the American Vocational Association. His criticism of those objectives was that they did not do an adequate job of interpreting the technology of industry to our youth.

Miller concluded that further studies must be concerned with the specific task of selecting and organizing classroom experiences for the fulfillment of industrial arts objectives.

In a response to the call for new objectives for the industrial arts, the American Vocational Association (1) has presented a new set of objectives. Their reasons for the new objectives are stated in the following discussion:

> At a time when new discoveries and developments in the sciences and technology are widening the educational lag, developing objectives for industrial arts needs real thinking and reasoning.
>
> Many of the objectives and goals of industrial arts in the past were either repetitious or geared to the popular theories of psychology of the times. As a result, the program and its justification was open to criticism when such theories were either generally abandoned or simply discarded in favor of newer or more exciting theories of the learning process.

The new objectives are somewhat of an answer to Rex Miller's call for objectives to interpret industry to our youth. These new objectives are unique to industrial arts and are not shared by other subject areas presently being taught in the school curriculum. These new objectives are:

1. To develop an insight and understanding of industry and its place in our culture.

2. To discover and develop talents, aptitudes, interests, and potentialities of individuals for the technical pursuits and applied sciences.

3. To develop an understanding of industrial processes and the practical application of scientific principles.

4. To develop basic skills in the proper use of common tools, machines, and processes.

5. To develop problem-solving and creative abilities relating to the materials, processes, and products of industry.

Malmberg (7) conducted a study concerned with the structure of an industrial arts program and its affect upon the methodologies and approaches used. The school that was studied was using a modular scheduling program. Methods and approaches that were different than a conventional school were:

1. Group size was changed to groups of over 150, 12 to 15, and individual instruction seminars.

2. The length of the class time was determined by the type of learning situation.

3. Instruction was done by team teaching, specialists, and instruction assistants.

4. Emphasis was placed on the students acceptance of responsibility for learning.

Although Malmberg's study was concerned with modular scheduling it is of some value in providing research for new methods and approaches for meeting the objectives for industrial arts.

A different approach to studying methods for industrial arts was attempted by Kaminski (5). He studied Washington State schools to determine what methods industrial arts teachers were using to meet the needs of the above-average student. According to this study many counselors schedule the slow learner in industrial arts courses. Mr. Kaminski stated that industrial arts has much to offer the above-average student because of industrial arts contribution to:

1. Socialization.
2. Application of scientific principles in practical situations.
3. The use of tools, materials, and machines in real situations instead of the abstract.

Kaminski concluded that:

1. Approximately 50 percent of the teachers were not meeting the needs of the above-average student.
2. A study is needed of successful methods used in teaching above-average students.
3. A study is needed to evaluate the importance of the industrial arts program for above-average students so better counseling could be done.

4. Most above-average students are being taught in regular classroom situations.

5. Teachers expected more from above-average students in work performance and helping other students.

6. Teachers methods for the above-average student did not vary from the methods for the average student.

All available literature indicates no research concerned directly with methods teachers use to meet their objectives. Probably the study by Miller accomplished much in establishing the need for new objectives for industrial arts. In the light of these new objectives, teachers can now re-evaluate their methods in meeting objectives.

METHOD OF PROCEDURE

Delimitations of Investigation

This study was concerned with the methods Iowa industrial arts teachers use to meet the national objectives for industrial arts. There were 250 industrial arts teachers initially contacted in this study.

Basic Assumptions

The following basic assumptions were made for the purpose of this study:

1. Not all teachers use the same methods for meeting objectives.
2. The selection of a teaching method depends upon the situation, the teacher and his experience.
3. The objectives as set forth by the American Vocational Association would be used as the national objectives.
4. Teachers place unequal values on the methods they use in meeting objectives.
5. The attitude statements were a valid and reliable measure of teacher's attitudes regarding the different methods.
6. The questionnaire used in this study would be answered honestly by the industrial arts teachers.

The Population Studied

The data for this study were secured from a total population of 945 Iowa industrial arts teachers. The population included all teachers in industrial arts who were listed in the Iowa Educational Directory (4) as of July 1, 1967. A random sample of 250 junior and senior high school industrial arts teachers was selected from the population by using a table of random numbers by Wert (12).

Development of Instrument

The instrument used to gather data from the industrial arts teachers was a questionnaire developed by the author. A copy of the questionnaire can be found in appendix A. The author constructed a short cover letter to introduce the reader to the questionnaire. The questions were designed so that the teacher could quickly make a check to indicate his answer. Data concerning each teacher were gathered to provide information concerning the following variables:

1. Number of years teaching experience.
2. The amount of undergraduate training in industrial arts.
3. What area of industrial arts constitutes the majority of the respondents teaching assignment.
4. What grade level of school the respondent taught in.
5. The size of the school system the respondent taught in.

Part II of the questionnaire was developed to determine what methods teachers used to meet objectives and the importance they placed on each method. Each objective was studied and the six methods for fulfilling that objective were selected from a methods book by Littrell (6). The methods were listed under each objective with directions to mark whether the method was used as well as the relative importance the teacher placed on each method. The same procedure was followed for each of the five objectives.

Part III of the questionnaire was concerned with any new or innovative methods the respondents might have used within the school year. They were requested to describe any new or innovative methods they have used to fulfill their objectives.

Pretesting the Instrument

The first draft of the questionnaire was prepared and presented to an evaluation panel of 21 industrial arts teachers and students in I. Ed. 652, Evaluation in Industrial Education. The questionnaire was presented to the panel much like a teacher would receive it in the mail. They were asked to complete the questionnaire and criticize it. The panel was timed so that an approximate completion time could be used for evaluating the length of the questionnaire. After the questionnaire was completed by the panel members, they were asked for comments concerning clarity of the questionnaire. Results of the pretesting brought about minor changes in wording to improve clarity of the questionnaire as well as restructuring some of the possible choices of answers.

Collection of Data

A questionnaire, cover letter, and an addressed return envelope were mailed to 250 industrial arts teachers on April 14, 1968. A total of 228 questionnaires were returned for a return of 91 percent. Five questionnaires were incomplete and were dropped from the study.

Analysis and Treatment of Data

Data from the questionnaires were coded and transferred to code sheets. The coded information was punched on International Business Machine (IBM) cards and verified. The computation center at Iowa State University of Science and Technology was used to process and analyze the data of this study.

Treatment of the information furnished by this study included percentages, frequency counts, and chi-square tests. Percentages were used to compare the responses. Frequency counts gave the number of responses according to selected variables and attitude ratings within each variable. The chi-square technique was used to determine relationships between methods used and teaching experience, undergraduate training in industrial arts, majority of teaching assignment, grade level of assignment, and size of the school. Because of the large amount of hypotheses tested, only selected hypotheses were presented in the findings section. The formula for figuring chi square was:

$$\frac{(\text{Actual frequency} - \text{Expected frequency})^2}{\text{Expected frequency}}$$

Since the expected frequencies were not available in the data, they were calculated from row and column totals.

FINDINGS

The data for this study will be presented in four general areas. The order will be: (1) characteristics of the sample, (2) the teaching methods used, (3) relationships of methods and sample characteristics, and (4) new and innovative methods.

Characteristics of the Sample

In considering factors that could influence teacher methods, four variables were tested. The breakdown of the responses in these variables will be presented first.

The first question requested the respondents to check the appropriate number of years they had been teaching. The data in Table 1 shows the number of responses included in the study by years of teaching experience.

Table 1. Number and percent of respondents by teaching experience

Years Experience	Number	Percent
Beginning to 5 years	66	30%
5 to 10 years	71	32%
10 to 15 years	28	12%
15 years or more	58	26%
Total	223	100%

The second question requested the respondents to check whether they had a major in industrial arts, minor in industrial arts, no degree in industrial arts, or whether no degree at all was possessed. The intended purpose of this question was to indicate how many industrial arts teachers did not receive their undergraduate training in industrial arts and if this difference in training had any effect on the teaching methods used. Data concerning the training of the respondents are presented in Table 2.

Table 2. Number and percent of respondents by undergraduate training

Training	Number	Percent
Major in industrial arts	175	78%
Minor in industrial arts	31	14%
Neither major nor minor - other	11	5%
No degree - degree not completed	6	3%
Total	223	100%

The area of emphasis in the respondents teaching assignment was the next category. This question was used to determine the relationship between teaching methods and area of emphasis in teaching the industrial arts. The data for industrial arts areas of emphasis are presented in Table 3.

Table 3. Number and percent of respondents by industrial arts area of emphasis

Industrial arts area of emphasis	Number	Percent
Woodworking	69	31%
Drafting	28	14%
Metals	28	14%
Power Mechanics	14	6%
Electricity-Electronics	6	3%
Graphic Arts	1	1%
Other	6	3%
Woodworking-Drafting	16	7%
General	55	21%
Total	223	100%

The respondents were requested to indicate the grade level of their teaching assignment for the fourth question. The intended purpose of this question was to discover if there was a difference in methodology according to grade level of teaching assignment. The data concerning grade level of teaching assignment are presented in Table 4.

The fifth question was used to determine a relationship between school size and the methods used for meeting industrial arts objectives. The distribution of the sample, according to school size, is quite even in all four areas. The data in Table 5 indicates the school size by student enrollment.

Table 4. Number and percent of respondents by grade level of teaching assignment

Grade level	Number	Percent
Junior high	59	27%
Senior high	103	46%
Both junior and senior high	61	27%
Total	223	100%

Table 5. Respondent distribution by student enrollment size

Student enrollment size	Number	Percent
Less than 200	50	22%
201 - 500	64	29%
501 - 800	50	22%
Over 801	59	27%
Total	223	100%

Teaching Methods Used

The second section of the questionnaire dealt with the number of respondents that used each method. From the data below it is evident that for developing an insight and understanding of industry in our culture (objective I), audio-visual aids and the lecture methods are practiced most. The data, which is presented under the "Importance" heading in Table 6 indicate that teachers place approximately the same value on both methods.

Table 6. Distribution of "yes" responses and importance of instructional methods for attaining objective I

Method	"yes" responses	% of sample	Importance				
			none	little	some	much	great
Lecture	206	92%	0%	7%	47%	39%	7%
Audio-visual materials	201	90%	0%	6%	42%	37%	15%
Discussion conference	176	79%	0%	7%	47%	37%	9%
Outside reading sources	171	77%	0%	19%	50%	23%	8%
Groups project	146	65%	0%	7%	41%	41%	11%
Resource people	88	40%	1%	25%	44%	11%	9%

In considering the objective of developing talents, aptitudes, and interests for the technical pursuits and applied sciences (objective II), 93 percent of the "yes" respondents reported the project method most practiced. The data (presented in Table 7) under the heading of importance, indicate 79 percent of the "yes" respondents for the project method thought of the methods as much or great in importance.

Table 7. Distribution of "yes" responses and importance of instructional methods for attaining objective II

Method	"yes" responses	% of sample	Importance none	little	some	much	great
Project	208	93%	0%	2%	19%	52%	27%
Discussion	178	80%	0%	11%	53%	28%	8%
Audio-visual materials	177	79%	0%	12%	45%	35%	8%
Tests	150	67%	0%	9%	51%	28%	12%
Field trips	101	45%	1%	17%	42%	32%	8%
Co-op work experience	64	29%	0%	9%	38%	39%	14%

In considering methods for meeting the objective of developing an understanding of industrial processes and the practical application of scientific principles, (objective III), three methods seem to be practiced most. These methods are the demonstration method (95 percent of total sample), project method (92 percent), and lecture (91 percent). The data under the heading of importance indicate that although the lecture method is practiced frequently, its importance is somewhat lower than the demonstration and project method. The data for objective III is presented in Table 8.

The project (98 percent of total respondents), lecture (94 percent), and demonstration method (98 percent) are used most frequently in meeting the

Table 8. Distribution of "yes" responses and importance of instructional methods for attaining objective III

Method	"yes" responses	% of sample	Importance none	little	some	much	great
Demonstration	211	95%	0%	2%	31%	46%	21%
Project	205	92%	0%	3%	23%	50%	24%
Lecture	203	91%	0%	7%	53%	33%	7%
A-V material	188	84%	0%	12%	42%	33%	13%
Discussion	167	75%	0%	15%	56%	23%	6%
Experimental	131	59%	1%	13%	40%	31%	15%

objective of developing basic skills in the proper use of common industrial tools, machines, and process (objective IV). Again, as in objective III, the lecture method is practiced by many (94 percent), but its relative importance is indicated to be below the project and demonstration method. The "yes" response data are presented in Table 9.

The fifth objective is concerned with development of problem-solving abilities related to the materials, processes, and products of industry. The project and demonstration methods are used most frequently with 91 percent of total respondents using these methods. By looking at the relative importance chart in Table 10, one can see that more importance is placed on the project method than the demonstration method for meeting this objective.

Table 9. Distribution of "yes" response and importance of instructional methods for attaining objective IV

Method	"yes" responses	% of sample	Importance				
			none	little	some	much	great
Project	218	98%	0%	1%	16%	51%	32%
Demonstration	218	98%	0%	2%	25%	53%	20%
Lecture	209	94%	0%	8%	55%	31%	6%
A-V materials	183	77%	0%	11%	47%	33%	9%
Programmed texts	85	38%	0%	13%	52%	27%	8%
Resource people	62	28%	0%	33%	27%	27%	11%

Table 10. Distribution of "yes" responses and importance of instructional methods for attaining objective V

Method	"yes" responses	% of sample	Importance				
			none	little	some	much	great
Project	204	91%	0%	2%	27%	47%	24%
Demonstration	204	91%	0%	6%	40%	40%	14%
Lecture	191	86%	0%	13%	55%	28%	4%
Discussion	162	73%	0%	12%	52%	28%	8%
Tests to evaluate problem solving abilities	160	72%	0%	10%	54%	25%	11%
A-V materials	154	69%	0%	17%	52%	21%	10%

In considering the "no" responses to objective I, one can note that although 60 percent of the respondents did not use resource people for developing an insight of industry, they did place some importance on it. The data for "no" responses to objective I are presented in Table 11.

Table 11. Distribution of "no" responses and importance of instructional methods for attaining objective I

Method	"no" responses	% of sample	Importance none	little	some	much	great
Resource people	135	60%	65%	3%	11%	18%	3%
Group project	77	35%	68%	8%	16%	8%	0%
Outside reading	52	23%	63%	8%	25%	2%	2%
Discussion	47	21%	68%	4%	28%	0%	0%
A-V materials	22	10%	59%	5%	5%	18%	13%
Lecture	17	8%	76%	12%	6%	6%	0%

The distribution of using field trips to develop interests in technical pursuits and applied sciences is fairly even in objective II. The distribution for the "yes" response was 45 percent and 55 percent for "no" response. The "no" response data to objective II are presented in Table 12.

Table 12. Distribution of "no" responses and importance of instructional methods for attaining objective II

Method	"no" responses	% of sample	Importance none	little	some	much	great
Co-op work program	159	71%	73%	4%	11%	7%	5%
Field trips	122	55%	75%	5%	7%	9%	4%
Tests to evaluate aptitudes	73	33%	67%	10%	18%	4%	1%
A-V materials	46	21%	76%	4%	9%	7%	4%
Discussion	45	20%	69%	4%	23%	4%	0%
Projects	15	7%	80%	0%	0%	20%	0%

The data in Table 13 indicate that 23 percent of the teachers responding "no" to the discussion or conference method feel there is some importance to the method in meeting objective III.

The majority of teachers do not use or favor using programmed materials or resource people in industry for teaching basic skills in use of tools (objective IV). Seventy-two percent of the respondents do not use resource people and 62 percent do not use programmed texts of any kind. The data for the "no" responses to objective IV are presented in Table 14.

Very little importance is placed on any of the methods in objective V by the "no" respondents. This would seem to indicate that those who do not use these

Table 13. Distribution of "no" responses and importance of instructional methods for attaining objective III

Method	"no" responses	% of sample	Importance none	little	some	much	great
Experimental	92	41%	74%	3%	9%	11%	3%
Discussion-conference	56	25%	70%	2%	23%	4%	1%
A-V material	35	16%	66%	5%	9%	9%	11%
Lecture	20	9%	70%	20%	10%	0%	0%
Project	18	8%	72%	0%	17%	11%	0%
Demonstration	12	5%	67%	0%	8%	17%	8%

Table 14. Distribution of "no" responses and importance of instructional methods for attaining objective IV

Method	"no" responses	% of sample	Importance none	little	some	much	great
Resource people	160	72%	72%	14%	11%	9%	4%
Programmed texts	138	62%	70%	9%	16%	5%	0%
A-V materials	40	33%	65%	3%	20%	10%	29%
Lecture	14	6%	72%	14%	14%	0%	0%
Demonstration	5	2%	80%	0%	0%	10%	29%
Project	5	2%	80%	0%	0%	0%	20%

methods are sure that they are of very little importance. The "no" response data for developing problem solving abilities are presented in Table 15.

Table 15. Distribution of "no" responses and importance of instructional methods for attaining objective V

Method	"no" responses	% of sample	Importance none	little	some	much	great
A-V materials	69	31%	67%	7%	12%	13%	1%
Test-evaluate problem-solving	63	28%	75%	6%	16%	3%	0%
Discussion	61	27%	70%	9%	16%	3%	2%
Lecture	32	14%	75%	9%	9%	7%	0%
Project	19	9%	63%	5%	5%	22%	5%
Demonstration	19	9%	68%	0%	16%	11%	5%

Chi Square

In order to determine the relationship between methods used and the variables, teaching experience, training in industrial arts, teaching area of emphasis, grade level of teaching, and school size, chi square values were computed for the following: years of teaching experience and methods used, training in industrial arts and methods used, teaching area of emphasis and methods used, grade level of teaching and methods used, and grade level and methods used.

Hypotheses Tested

Because 150 hypotheses and the same amount of chi square values were computed, only selected hypotheses will be presented in this section.

Years teaching experience

The hypothesis that there is no significant difference in selection of field trips as a method of developing aptitudes, interests, and potentialities (objective I) was first analyzed in relation to years of teaching experience. Data in Table 16 show the proportions from which the chi-square values were determined.

Table 16. Years teaching experience and "yes-no" responses for field trips (objective I, part 1)

	Beginning to 5 yrs.	5-10 yrs.	10-15 yrs.	15 yrs. or more	Total
"yes"	26	43	9	23	101
"no"	40	28	19	35	122
Total	66	71	28	58	

The chi square value determined from the proportion shown in Table 16 was 10.3067. This value is significant at the .05 level with three degrees of freedom. Table value required for significance at the .05 level was 7.815.

According to the resulting chi square value, the null hypothesis was rejected. There is a significant difference in the selection of field trips for developing aptitudes, interests, and potentialities for the technical pursuits and applied sciences when years of teaching experience is considered.

The other chi square values for teaching experience and methods used can be found in Table 21, Appendix B.

Amount of undergraduate training

In order to keep the cell size at sufficient number, the last two categories which dealt with whether the respondents had no degree in industrial arts or no degree at all was possessed, were combined and called other training. The hypothesis that there is no significant difference in selection of self-instructional materials as a method for developing basic skills in the proper use of common tools, machines, and processes (objective IV) was analyzed by amount of undergraduate training. The data in Table 17 show the proportions from which the chi square values were determined.

Table 17. Amount of undergraduate training and "yes-no" responses for self-instructional materials

	Major in I. A.	Minor in I. A.	Other training	Total
"yes"	60	19	6	85
"no"	115	12	11	138
Total	175	31	17	

The chi square value determined from the proportions in Table 17 was 8.2039. This value is significant at the .05 level with two degrees of freedom. The table value required for significance at the .05 level was 5.991.

According to the resulting chi square value, the null hypothesis was rejected. There is a significant difference in the selection of self-instructional materials for developing basic skills in the proper use of common industrial tools, machines, and processes when undergraduate training is considered.

The remainder of the chi square values for undergraduate training and methods used can be found in Table 22, Appendix B.

Industrial arts area of teaching emphasis

Combining of several categories was necessary for the chi square treatment for industrial arts teaching area of emphasis. Because there were very few respondents who taught power mechanics, electricity-electronics, and graphic arts, these areas were deleted for this portion of the study. The author reasoned that combining the areas would not give a true representation of the distinct areas of industrial arts.

The hypothesis that there is no significant difference in selection of self-instructional materials as a method of developing basic skills in the proper use of common tools, machines, and processes (objective IV) was analyzed by the area of teaching emphasis. The data in Table 18 show the proportions from which the chi square values were determined.

Table 18. Area of teaching emphasis and "yes-no" response for self-instructional materials

	Woodworking	Drafting	Metals	Woodworking-drafting	General	Total
"yes"	16	14	16	8	17	71
"no"	53	14	12	8	38	125
Total	69	28	28	16	55	

The chi square value determined from the proportions in Table 18 was 14.6658. This value is highly significant at the .01 level with four degrees of freedom. The table value for high significance at the .01 level was 13.277.

According to the resulting chi square value, the null was rejected. There is a highly significant difference in the selection of self-instructional material for developing basic skills in the proper use of common industrial tools, machines, and processes when industrial arts area of teaching emphasis is considered. The remainder of the chi square values for area of teaching emphasis can be found in Table 23, Appendix B.

Grade level of assignment

The hypothesis that there is no significant difference in the use of resource people in industry as a method of developing an insight and understanding of industry was analyzed by grade level of the teaching assignment. The data in Table 19 show the proportions from which the chi square values were determined.

Table 19. Grade level of teaching assignment and "yes-no" responses for using resource people

	Junior high	Senior high	Both	Total
"yes"	17	50	21	88
"no"	42	53	40	135
Total	59	103	61	

The chi square value determined from the proportions in Table 19 was 7.0039. This value is significant at the .05 level with two degrees of freedom. The table value required for significance at the .05 level was 5.991.

According to the resulting chi square value, the null hypothesis was rejected. There is a significant difference in the use of resource people as a method of developing an insight and understanding of industry when grade level of teaching assignment was considered. The remainder of the chi square values for grade level of teaching assignment can be found in Table 24, Appendix B.

School size

The hypothesis that there is no significant difference in the use of self-instructional materials as a method of developing basic skills in the use of common industrial tools, machines, and processes was analyzed by the size of the school where the respondent taught. The data in Table 20 show the proportions from which the chi square values were determined.

Table 20. School size and "yes-no" responses for using self-instructional materials

	less than 200	201-500	501-800	over 801	Total
"yes"	15	19	21	30	85
"no"	35	45	28	29	137
Total	50	64	49	59	

The chi square value determined from the proportions in Table 20 was 7.8288. This value is significant at the .05 level with three degrees of freedom. The table value required for significance at the .05 level is 7.815. There is a significant difference in the selection of field trips for developing aptitudes, interest, and potentialities for the technical pursuit and applied sciences when school size is considered. The remainder of the chi square values for school size are presented in Table 25, Appendix B.

New and Innovative Methods

The last part of the questionnaire requested the respondent to explain any new methods which had been used this past year. Forty-three respondents, 19 percent, filled out this portion of the questionnaire. The returns were grouped into four general categories. These categories were: audio-visual materials, personal and course re-evaluation, general methodology, and work in mass-production.

The responses in this section may not be new or innovative methods to all teachers, but nevertheless they do reflect an effort of teachers trying to improve their instructional program.

Audio-visual materials

Representative the responses under this category is:

> I have used the video tape and recorder for demonstration purposes concerning the set-up and use of oxy-acetylene welding equipment and also how to adjust and use the desk-type drafting machine.

Personal and course re-evaluation

Responses in this category range from one extreme to the other. Two of the responses in this category are:

> I plan to put more emphasis on the conference method. This is the first year I have used this method and I felt it was very helpful. Resource people have helped my program gain respect and direction.

> I just made the same old ruts a little deeper.

General methodology

The following responses are representative of new methods in this category:

> To have certain students help the others during the class. One day out of the year to plan the class period as well as conduct it under my supervision.

> Have done more problem-solving and research. Experimental type teaching.

Mass-production

The majority of responses for new and innovative methods dealt with mass production. The following are a cross-section of the responses.

> Designed-construction-mass-production project for school use. Started use of plastisol--infectors vacuum forms, and plastic casting. We have students design all their own products. Junior high have a career day for guidance purposes. We operate with two classes in shop at same time on two different grade levels (team teach same areas).

> We have a mass production project in which the entire class participates in the assembly line production of a foot stool. The class evaluates each of the various operations involved and makes recommendations for improvements in jigs, fixtures, and techniques. These recommendations are then utilized during the next production run. We have improved our efficiency considerable since the first production run.

All of the responses for this section of the questionnaire can be found in Appendix C.

DISCUSSION

This study was an attempt to determine what methods Iowa industrial arts teachers are using to meet instructional goals. The approach used was to determine: (1) certain characteristics about the sample, (2) what teaching methods are being used, (3) relationships of methods and sample characteristics, and (4) new and innovative methods that are being used.

Characteristics of the sample

In examining the years of teaching experience (Table 1), one can notice that there is a considerably lower number of respondents in the category of 10-15 years teaching experience. This decrease might be explained by a number of theories, two of which are worth mentioning. The drop in this experience group may be explained by attrition. After ten years of teaching, teachers either decide to stay in education or leave teaching and enter another occupation. It seems reasonable to assume that after ten years, one becomes more concerned about welfare and job future. Therefore, it might be the period of 10-15 years when this decision is made.

Another theory might be that teachers who received their training 10-15 years ago might have been involved with the Korean conflict. Possibly at this time period the rank of students in industrial arts programs could have been thinned by the war.

It must be remembered that these are only theories and no evidence has been collected to substantiate them. Certainly this is an interesting problem and well worth some further investigation.

In regard to undergraduate training in industrial arts, the findings of this study agree somewhat with the findings of Hahn (2). Hahn reported that 72 percent of his respondents had an undergraduate major in industrial arts, and seven percent with no degree. The results of this study show that 78 percent had majors in industrial arts and only three percent had no degree or their degree was not completed.

The results from the area of teaching emphasis also agree with the results of Hahn's study. He reported that woodworking and drafting still predominate in total time alloted. In looking at Table 3 the question might be asked as to why so little electricity-electronics is reported. The question in the questionnaire requested the respondent to mark the area which constituted the majority of his teaching assignment. The results showed that only six respondents of the 223 reported electricity-electronics as the area that constituted the majority of their teaching assignment. This is not to say that electricity-electronics is not offered at more schools. In the majority of cases where teachers reported equal time to several areas such as woodworking, drafting, metals, and electricity-electronics, they were placed in the general shop category. This accounts for the small amount which reported electricity-electronics as their major teaching assignment.

Teaching methods used

The tendency of using mainly three methods for meeting instructional goals was well established throughout this section of the questionnaire. In developing an insight and understanding of industry (objective I) 92 percent reported the lecture method. For developing and discovering talents, aptitudes, interests and potentialities of individuals for the technical pursuits and applied sciences, (objective II) the laboratory or project method (93 percent) was reported the most. The project method (92 percent) and demonstration (95 percent) were the most reported for developing principles (objective III). To meet objective IV, developing basic skills in the proper use of common industrial tools and machines, the project method (98 percent) and demonstration method (98 percent) are again the most practiced. Following this same line, the same two are the most reported (91 percent) for developing problem-solving abilities relating to industry (objective V).

It is the author's opinion that several methods are highly overworked in meeting instructional goals. No area that is as broad as industrial arts can be adequately covered by using two or three instructional methods over and over again. It seems much closer to the truth when one respondent accurately answered that for new and innovative methods, he just made the same old ruts a little deeper. Industrial arts is an exciting and interesting phase of education and should not be limited to lecturing on Monday and demonstrating and working on foot stools the rest of the week. There are too many teachers who find this rut too easy to fall into.

Relationships of methods and sample characteristics

The intended purpose of this section was to find out what influenced the selection of an instructional method. This section fell short of the author's expectations. Because of the very high "yes" responses to such methods as projects, demonstrations, and lectures, the cells in the "yes-no" breakdown were of insufficient size to place any value on the resulting chi square. This problem happened in 53 of the 150 chi square values. If some of the sections had not been combined and deleted, whole sections of the study such as teaching area of emphasis would have been useless.

In reviewing the chi square data, it seems that the only methods which are affected to any great extent are the field trips, use of programmed materials, and resource people from industry.

The chi square data indicate that there is a significant difference in the selection of field trips as a teaching method when related to teaching experience and grade level of teaching assignment. The significant chi square value for years teaching experience and use of field trips seems to indicate a difference of opinion as to the value of this method.

The data in Table 16 indicate that the "yes-no" responses in beginning to five years and five-ten years are completely opposite of each other. In the category of beginning to five years, 26 replied "yes" to using field trips and 40 replied "no". However, in five-ten years teaching experience 43 replied "yes" to using field trips and 28 replied "no". This complete reversal is interesting and no endeavor at theorizing as to the cause will be attempted.

The chi square study also indicated that in relation to selection of programmed texts etc. as a teaching method, there is:

1. A significant difference in selection when related to undergraduate training.

2. A highly significant difference in selection when related to area of teaching emphasis.

3. A significant difference in selection when related to the size of the school.

The chi square values indicate that when programmed materials are used, their selection is dependent upon undergraduate training, area of teaching emphasis, and the size of the school.

Under the category of undergraduate training (Table 17), 34 percent of the majors reported use of programmed materials, as compared to 61 percent of the industrial arts minors. It is the author's opinion that this difference might be that those who teach industrial arts with a minor may have been exposed to programmed materials in their major area of undergraduate training.

The breakdown of "yes-no" respondents for use of programmed materials and school size (Table 20) indicates that programmed materials are practiced much more in larger schools. It is the author's opinion that the wider use of programmed texts in the larger school system seems to indicate a more rounded program and well so because of more operating funds.

When considering the relationship between the use of resource people and grade level of teaching assignment, a significant difference was found. The dependence of using resource people upon grade level of assignment should be quite evident since the large majority of resource people are used only in high school programs.

Except for field trips, resource people, and programmed materials, the chi square values did not indicate a significant difference in method selection and characteristics of the sample which might have influenced it. As was stated before, the small cell size of many categories did not allow a good chi square test of the relationships between methods used and factors which may influence method selection. It is the author's opinion that if a larger sample had been taken, this problem might have been eliminated.

New and innovative methods

It is the author's opinion that some industrial arts teachers are doing a fine job in looking for new and innovative ways of meeting instructional goals. Such methods as using video tape recorder application of scientific experiments, and experimentation with industrial arts materials are some examples of what teachers are doing.

Suggestions for further study

Further research is needed in the area of method selection and what factors influence teaching methods. It is the author's opinion that if funds and time were available, a more accurate indication of teachers' methods could be evaluated if a personal interview could have been arranged with a number of teachers. This would help to eliminate the error of a questionnaire and also promote honesty on the part of the respondent.

SUMMARY

Industrial arts is in the position of being able to utilize many instructional methods for meeting its goals. Some of these methods are:

1. Laboratory or project method.
2. Discussion-conference method.
3. Lectures.
4. Self-instructional materials.
5. Field trips.
6. Demonstrations.
7. Audio-visual materials.
8. Resource people from industry.
9. Cooperative work experience programs.

The purposes of this study were threefold. They were: (1) to determine what methods are used by Iowa industrial arts teachers, (2) to determine what affects the selection of instructional methods, and (3) what new or innovative methods teachers are using to meet their objectives.

Eight objectives were stated:

1. To determine what methods Iowa industrial arts teachers use to meet instructional objectives.
2. To determine what importance Iowa industrial arts teachers place on instructional methods.

3. To determine if instructional method selection was influenced by number of years teaching experience.

4. To determine if instructional method selection was influenced by the amount of undergraduate training in industrial arts.

5. To determine if instructional method selection was influenced by the teaching area of emphasis.

6. To determine if instructional method selection was influenced by the grade level of the teaching assignment.

7. To determine if instructional method selection was influenced by the size of the school system.

8. To determine what new or innovative methods Iowa industrial arts teachers are using to meet instructional objectives.

The data for this study were gathered from 223 Iowa junior and senior high industrial arts teachers. The instrument used was a questionnaire designed by the author.

Results from this study indicated that for 78 percent of the respondents, industrial arts was the major field of study in their undergraduate education. Woodworking still comprises the majority of emphasis in industrial arts programs. Thirty-five percent of the respondents indicated that woodworking constituted the majority of their teaching assignment.

The compiled data of this study indicate that the majority of industrial arts teachers attain their instructional objectives with just three methods. These methods are the project, demonstration, and lecture methods.

The chi square statistical technique was used to determine a relationship between method used and the sample characteristics of teaching experience, training in industrial arts, teaching area of emphasis, grade level of teaching assignment, and school size. Because of the very high proportion of respondents who reported the use of projects, demonstrations, and lecture, 53 of the 150 chi square values lacked sufficient cell size to place any reliability on the results. However, the chi square study did indicate that:

1. The selection of field trips as an instructional method is related to years teaching experience and grade level of teaching assignment.
2. The selection of resource people from industry as an instructional method is related to grade level of teaching assignment.
3. The selection of programmed materials as an instructional method is related to undergraduate training in industrial arts, teaching area of emphasis and school size.

Iowa industrial arts teachers are using such new methods as video tape recorders for demonstrations, use of more experimentation by the students, and exposing students to application of more scientific principles such as materials testing etc.

The general conclusion is that industrial arts teachers are not using all of the instructional methods that are available to them for meeting instructional goals. The chi square statistical treatment employed in this study was insufficient to prove that teaching experience, amount of undergraduate training in industrial arts, area of teaching emphasis, grade level of teaching assignment, and school size are significantly related to the teaching method used.

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APPENDIX A. COVER LETTER AND QUESTIONNAIRE

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY
Ames, Iowa 50010

DEPARTMENT OF EDUCATION

Dear Industrial Arts Teacher:

You have been selected as a source of information for a study of methods Iowa industrial arts teachers are using to meet the national objectives for industrial arts as proposed by the American Vocational Association.

You will note that you can quickly check your answers on the enclosed questionnaire. A stamped-addressed envelope is enclosed for your early reply.

Your cooperation in answering the questions will be valuable to all industrial arts teachers in Iowa.

Sincerely,

Lowell L. Carver, Chairman
Industrial Education

Robert L. Schuster

QUESTIONNAIRE

Check the appropriate number of years you have been teaching.

1. _____ Beginning to 5 years 3. _____ 10 to 15 years
2. _____ 5 to 10 years 4. _____ 15 years or more

Check whether you have an undergraduate major or minor in industrial arts.

1. _____ Major in industrial arts 3. _____ Neither major nor minor - other
2. _____ Minor in industrial arts 4. _____ No degree--degree not completed

Check which industrial arts area of emphasis constitutes the majority of your teaching assignment.

1. _____ Woodworking 5. _____ Electricity - Electronics
2. _____ Drafting 6. _____ Graphic Arts
3. _____ Metals 7. _____ Other ____________________
4. _____ Power Mechanics

Check whether you teach in junior high or senior high school.

1. _____ Junior High 2. _____ Senior High 3. _____ Both

Check the appropriate student enrollment in your particular junior or senior high school.

1. _____ Less than 200 3. _____ 501 - 800
2. _____ 201 - 500 4. _____ Over 801

- - - - - - - - - - -

DIRECTIONS:

This instrument was developed to measure and determine by your reactions and replies, what methods you are using to meet certain objectives. This questionnaire is divided into five sections. Each section is devoted to one of the objectives as proposed by the American Vocational Association. Please mark whether or not you use each of the methods, and the relative importance that you place on each method. The methods are not placed in any order of importance.

Section I

During this past year of teaching, which of the following methods or materials have you used to develop an insight and understanding of industry and its place in our culture?

	Used		Importance				
	Yes	No	None	Little	Some	Much	Great
1. The group project method.							
2. Discussion-conference method.							
3. Audio-Visual materials (films, slides, etc.)							
4. Resource people (people from industry).							
5. Lecture method.							
6. Outside reading sources (magazine articles, etc.)							

Section II

During this past year of teaching, which of the following methods or materials have you used to develop and discover talents, aptitudes, interests and potentialities of individuals for the technical pursuits and applied sciences?

	Used		Importance				
	Yes	No	None	Little	Some	Much	Great
1. Field trips.							
2. Discussion or conference methods.							
3. Laboratory or project methods.							
4. Audio-visual materials (films, slides, etc.)							
5. Tests (to evaluate aptitudes, interests, etc.)							
6. Cooperative work experience program.							

Section III

During this past year of teaching, which of the following methods or materials have you used to develop an understanding of industrial processes and the practical application of scientific principles?

	Used		Importance				
	Yes	No	None	Little	Some	Much	Great
1. Project method.							
2. Lecture method.							
3. Demonstration method.							
4. Audio-visual materials (films, slides, etc.)							
5. Discussion or conference methods.							
6. Experimental method (experiments that the student performs)							

Section IV

During this past year of teaching, which of the following methods or materials have you used to develop basic skills in the proper use of common industrial tools, machines, and processes?

	Used		Importance				
	Yes	No	None	Little	Some	Much	Great
1. Project method.							
2. Lecture method.							
3. Self-instructional materials (programmed texts).							
4. Demonstration method.							
5. Audio-visual materials (films, slides, etc.)							
6. Resource people (skilled persons in labor).							

Section V

During this past year of teaching, which of the following methods or materials have you used to develop problem-solving abilities relating to the materials, processes, and products of industry?

	Used		Importance				
	Yes	No	None	Little	Some	Much	Great
1. Project method.							
2. Lecture method.							
3. Discussion or conference method.							
4. Demonstration method.							
5. Tests (to evaluate problem-solving abilities).							
6. Audio-visual materials (films, slides, etc.)							

During this past year, have you used any new or innovative methods in teaching? If so, please explain.

____

____

____

____

APPENDIX B. CHI SQUARE RESPONSES AND METHODS USED

Table 21. Chi square values for teaching experience and methods used

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with three degrees of freedom.

** = Highly significant at .01 level with three degrees of freedom.

Method	chi square
Objective I--to develop an insight and understanding of industry and its place in our culture.	
1. The group project method.	5.1864
2. Discussion - conference method.	3.4333
3. Audio - visual materials (films, slides, etc.).	1.0962
4. Resource people (people from industry).	1.7113
5. Lecture method.	2.0890 (1)
6. Outside reading (magazine articles, etc.).	6.4141
Objective II--to develop and discover talents, aptitudes, interests and potentialities of individuals for technical pursuits and applied sciences.	
1. Field trips.	10.3067 *
2. Discussion or conference methods.	.5921
3. Laboratory or project methods.	5.1232 (1)
4. Audio - visual materials (films, slides, etc.).	2.4630
5. Tests (to evaluate aptitudes, interests, etc.).	3.5871
6. Cooperative work experience program.	6.4120
Objective III--to develop an understanding of industrial processes and the practical application of scientific principles.	
1. Project method.	5.3700 (1)
2. Lecture method.	1.2669
3. Demonstration method.	1.4090 (1)
4. Audio-visual materials (films, slides, etc.).	1.7777
5. Discussion or conference methods.	4.7805
6. Experimental methods. (Experiments that the student performs.)	1.4040

Table 21 (Continued)

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with three degrees of freedom.

** = Highly significant at .01 level with three degrees of freedom.

Method	chi square
Objective IV--to develop basic skills in the proper use of common industrial tools, machines, and processes.	
1. Project method.	4.9545 (1)
2. Lecture method.	2.4924 (1)
3. Self-instructional materials (programmed texts).	1.5244
4. Demonstration method.	4.7298 (1)
5. Audio-visual materials (films, slides, etc.).	2.3794
6. Resource people (skilled persons in labor).	1.5375
Objective V--to develop problem-solving abilities relating to the materials, processes, and products of industry.	
1. Project method.	1.3010 (1)
2. Lecture method.	.8155
3. Discussion or conference method.	1.1696
4. Demonstration method.	4.1526 (1)
5. Tests (to evaluate problem-solving abilities).	1.4556
6. Audio-visual materials (films, slides, etc.).	5.3000

Table 22. Chi square values for undergraduate training and methods used

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with two degrees of freedom.

** = Highly significant at .01 level with two degrees of freedom.

Method	chi square
Objective I--to develop an insight and understanding of industry and its place in our culture.	
1. The group project method.	0.7550
2. Discussion-conference method.	0.1305
3. Audio-visual materials (films, slides, etc.).	0.4934 (1)
4. Resource people (people from industry).	3.7012
5. Lecture method.	10.7986 (1)
6. Outside reading (magazine articles, etc.).	3.6025
Objective II--to develop and discover talents, aptitudes, interests and potentialities of individuals for technical pursuits and applied sciences.	
1. Field trips.	1.6422
2. Discussion or conference methods.	0.9739
3. Laboratory or project methods.	0.7457 (1)
4. Audio-visual materials (films, slides, etc.).	1.6440
5. Tests (to evaluate aptitudes, interests, etc.).	1.6933
6. Cooperative work experience program.	4.8717
Objective III--to develop an understanding of industrial processes and the practical application of scientific principles.	
1. Project method.	10.2095 (1)
2. Lecture method.	22.6712 (1)
3. Demonstration method.	1.6629 (1)
4. Audio-visual materials (films, slides, etc.).	1.3651 (1)
5. Discussion or conference methods.	0.7472
6. Experimental methods. (Experiments that the student performs.)	1.776

Table 22 (Continued)

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with two degrees of freedom.

** = Highly significant at .01 level with two degrees of freedom.

Method	chi square
Objective IV--to develop basic skills in the proper use of common industrial tools, machines, and processes.	
1. Project method.	1.3871 (1)
2. Lecture method.	10.7510 (1)
3. Self-instructional materials (programmed texts)	8.2039 *
4. Demonstration method.	1.3871 (1)
5. Audio-visual materials (films, slides, etc.).	4.9220
6. Resource people (skilled persons in labor).	3.7678
Objective V--to develop problem-solving abilities relating to the materials, processes, and products of industry.	
1. Project method.	6.0196 (1)
2. Lecture method.	1.4528 (1)
3. Discussion or conference method.	1.1513
4. Demonstration method.	10.6939 (1)
5. Tests (to evaluate problem-solving abilities).	1.5782
6. Audio-visual materials (films, slides, etc.).	1.2503

Table 23. Chi square values for area of teaching emphasis and methods used

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with four degrees of freedom.

** = Highly significant at .01 level with four degrees of freedom.

Method	chi square
Objective I--to develop an insight and understanding of industry and its place in our culture.	
1. The group project method.	3.7035
2. Discussion-conference method.	8.1737
3. Audio-visual materials (films, slides, etc.).	0.6357 (1)
4. Resource people (people from industry).	3.5472
5. Lecture method.	1.3789 (1)
6. Outside reading (magazine articles, etc.).	0.8951
Objective II--to develop and discover talents, aptitudes, interests and potentialities of individuals for technical pursuits and applied sciences.	
1. Field trips.	3.1171
2. Discussion or conference methods.	3.7053
3. Laboratory or project methods.	4.6663 (1)
4. Audio-visual materials (films, slides, etc.).	2.4298
5. Tests (to evaluate aptitudes, interests, etc.).	8.9719
6. Cooperative work experience program.	3.5947
Objective III--to develop an understanding of industrial processes and the practical application of scientific principles.	
1. Project method.	6.2508 (1)
2. Lecture method.	3.4967 (1)
3. Demonstration method.	7.6407 (1)
4. Audio-visual materials (films, slides, etc.).	5.2253 (1)
5. Discussion or conference methods.	7.6210
6. Experimental methods. (Experiments that the student performs.)	8.4382

Table 23 (Continued)

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with four degrees of freedom.

** = Highly significant at .01 level with four degrees of freedom.

Method	chi square
Objective IV--to develop basic skills in the proper use of common industrial tools, machines, and processes.	
1. Project method.	3.3156 (1)
2. Lecture method.	2.7148 (1)
3. Self-instructional materials (programmed texts).	14.6658 **
4. Demonstration method.	5.9622 (1)
5. Audio-visual materials (films, slides, etc.).	7.1716
6. Resource people (skilled persons in labor).	3.1348
Objective V--to develop problem-solving abilities relating to the materials, processes, and products of industry.	
1. Project method.	11.8812 (1)
2. Lecture method.	1.6766 (1)
3. Discussion or conference method.	11.1120 *
4. Demonstration method.	10.2812 (1)
5. Tests (to evaluate problem-solving abilities).	1.0541

Table 24. Chi square values for grade level of teaching assignment and methods used

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with two degrees of freedom.

** = Highly significant at .01 level with four degrees of freedom.

Method	chi square
Objective I--to develop an insight and understanding of industry and its place in our culture.	
1. The group project method.	2.4721
2. Discussion-conference method.	1.432
3. Audio-visual materials (films, slides, etc.).	1.2436
4. Resource people (people from industry).	7.0039 *
5. Lecture method.	0.0911 (1)
6. Outside reading (magazine articles, etc.).	2.3805
Objective II--to develop and discover talents, aptitudes, interests and potentialities of individuals for technical pursuits and applied sciences.	
1. Field trips.	13.2068 **
2. Discussion or conference methods.	0.5566
3. Laboratory or project methods.	0.4644 (1)
4. Audio-visual materials (films, slides, etc.).	0.887
5. Tests (to evaluate aptitudes, interests, etc.).	3.3399
6. Cooperative work experience program.	1.2196
Objective III--to develop an understanding of industrial processes and the practical application of scientific principles.	
1. Project method.	2.8455 (1)
2. Lecture method.	0.3426
3. Demonstration method.	1.5883 (1)
4. Audio-visual materials (films, slides, etc.).	0.1924
5. Discussion or conference methods.	0.6200
6. Experimental methods. (Experiments that the student performs.)	0.9357

Table 24 (Continued)

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with two degrees of freedom.

** = Highly significant at .01 level with four degrees of freedom.

Method	chi square
Objective IV--to develop basic skills in the proper use of common industrial tools, machines, and processes.	
1. Project method.	2.7203 (1)
2. Lecture method.	1.2326 (1)
3. Self-instructional materials (programmed texts).	0.6273
4. Demonstration methods.	0.3930 (1)
5. Audio-visual materials (films, slides, etc.).	1.1075
6. Resource people (skilled persons in labor).	7.2456 *
Objective V--to develop problem-solving abilities relating to the materials, processes, and products of industry.	
1. Project method.	2.5397
2. Lecture method.	1.2113
3. Discussion or conference method.	1.0001
4. Demonstration method.	2.5397
5. Tests (to evaluate problem-solving abilities).	0.8867

Table 25. Chi square values for school size and methods used

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with three degrees of freedom.

** = Highly significant at .01 level with three degrees of freedom.

Method	chi square
Objective I--to develop an insight and understanding of industry and its place in our culture.	
1. The group project method.	1.6291
2. Discussion-conference method.	3.1079
3. Audio-visual materials (films, slides, etc.).	1.8276 (1)
4. Resource people (people from industry).	7.4633
5. Lecture method.	3.9741 (1)
6. Outside reading (magazine articles etc.).	3.8507
Objective II--to develop and discover talents, aptitudes, interests and potentialities of individuals for technical pursuits and applied sciences.	
1. Field trips.	0.7548
2. Discussion or conference methods.	1.7006
3. Laboratory or project methods.	0.9817 (1)
4. Audio-visual materials (films, slides, etc.).	1.1749
5. Tests (to evaluate aptitudes, interests, etc.).	0.3400
6. Cooperative work experience program.	2.0119
Objective III--to develop an understanding of industrial process and the practical application of scientific principles.	
1. Project method.	9.9806 (1)
2. Lecture method.	11.8257 (1)
3. Demonstration method.	1.2408 (1)
4. Audio-visual materials (films, slides, etc.).	6.0042
5. Discussion or conference methods.	0.6338
6. Experimental methods. (Experiments that the student performs.)	5.0062

Table 25 (Continued)

Legend

(1) = Insufficient cell size to make test reliable.

* = Significant at .05 level with three degrees of freedom.

** = Highly significant at .01 level with three degrees of freedom.

Method	chi square
Objective IV--to develop basic skills in the proper use of common industrial tools, machines, and processes.	
1. Project method.	3.4505 (1)
2. Lecture method.	6.9507 (1)
3. Self-instructional materials (programmed texts).	7.8288 *
4. Demonstration methods.	2.3079 (1)
5. Audio-visual materials (films, slides, etc.).	5.1697
6. Resource people (skilled persons in labor).	3.9432
Objective V--to develop problem-solving abilities relating to the materials, processes and products of industry.	
1. Project method.	0.1886 (1)
2. Lecture method.	7.3624
3. Discussion or conference method.	1.3168
4. Demonstration method.	4.6065 (1)
5. Tests (to evaluate problem-solving abilities).	4.6771
6. Audio-visual materials (films, slides, etc.).	3.7011

APPENDIX C. RESPONSES FOR NEW AND INNOVATIVE METHODS

Table 26. Responses for new or innovative methods used in teaching

Audio visual aids

I have used the video tape and recorder for demonstration purposes concerning the set-up and use of oxy-acetylene welding equipment and also how to adjust and use the desk-type drafting machine.

Tapes for tests and make up work.

Beginning to get started with a T.V. camera and using video tape demonstrating.

Considerable use of overhead projector obtained through NDEA Funds. Have been using mass production for last three years. Have been using student materials experimentations for properties and characteristics for last four years.

I have found that junior high boys' attention span is very short. I try and teach toward this, breaking monotony as much as possible. We have audio visual materials intricately spaced for this reason also.

Use of overhead projector. Use of live aircraft for projects for advanced students on major repairs.

Course re-evaluation program changes

I plan to put more emphasis on the conference method. This is the first year I have used this method, and I felt it was very helpful. Resource people have helped my program gain respect and direction.

I just made the same old ruts a little deeper.

Nothing new, but I do try to have the student do as much of his own thinking and problem-solving as possible. Teaching the student to think for himself is one of the most important factors.

It is difficult to take field trips from such a small community, or allowing students opportunity to work and learn in industry.

No--but each year and even day, your plans must be changed to meet new situations and problems.

Table 26 (Continued)

None, but the Davenport system is in critical need to re-examine its goals and its methods--we need to re-organize on the basis of planning time for all instructors. In short, there is little time for innovative measures.

We have started to write out objectives in terms of behavioral patterns.

Group evaluation, teaching and actual production of microfilming drawings, taped lectures and discussion.

General methodology

No, we have a nine weeks exploratory course in hand tools at the seventh grade level and a six weeks course in general electricity for eighth grade. It is rather difficult to work in much industrial ideas during such a short time.

I have, in my general shop, started giving nine weeks of each area instead of all activities taking place at the same time. This I find works much better.

I use a weekly work grading number system to develop good habits and good citizenship among class members. This grade is posted for students to see.

Work which has been done outside the shop and then brought back to the school shop to be discussed.

In electricity each student has a kit from Lab. Volt., a work book and text book. Four weeks were spent in house wires. Electronics kit from Lab. Volt., work book and text book, a full year. Some individual projects. Auto Tech--mostly text book, lots of films, some lab work, very little, actual work on cars.

My principal likes my each-one-teach-one method (name borrowed from Frank Lavback, the eminent linguist). Rather than depending on lectures, etc., or much group work to introduce new tools, skills, etc., I show and/or help the first one in a class and let him pass it on to the next, etc.

Self taught instructional foundry unit.

Table 26 (Continued)

The correlation of project design between the art class and the woodworking project.

Construction of drawing of storage sheds and benches, and then actual construction.

Yes--studying new industries, such as concrete and cement, space age, nuclear energy, masonry, local industries, etc.

Let students reinforce their learning by helping or showing other students how to perform certain skills.

Team teaching.

We are implementing some phases of flexible or modular scheduling this year. In the next few years the entire school will be on flexible schedules if ours is a success.

Have done more problem solving and research. Experimental type teaching.

To have certain students help the others during the class. One day out of the year to plan the class period as well as conduct it under my supervision.

I have developed my own book utilizing the creative problem assignments rather than the copy method of technical drawing.

I've used a mass production procedure. I've also attempted to have each student prepare an experiment and demonstrate it to the class, one which deals with industrial arts.

Mass production

We have a mass production project in which the entire class participates in the assembly line production of a foot stool. The class evaluates each of the various operations involved and makes recommendations for improvements in jigs, fixtures, and techniques. These recommendations are then utilized during the next production run. We have improved our efficiency considerably since the first production run.

Table 26 (Continued)

Designed construction-mass-production project. For school use. Started use of plastisol-injectors, vacuum forms, and plastic casting. We have students design all their own projects. Junior high have a career day for guidance purposes. We operate with two classes in shop at same time on two different grade levels (team teach same areas).
A different mass production project for beginning students. A revised first year course to cover all our I. A. areas.
We set up some project and have classes mass produce it to demonstrate how many jobs in industry are carried out.
Yes, I have tried to carry a products development through all the various phases up to the actual construction of the product. The students were to design a labor saving device and develop bills of material. Step by step procedures, orthagraphic, isometric drawings, cost list and complete explanation of this new product, plus an advertisement. It didn't work as well as I had hoped, I am going to try it again.
I have a good unit on mass production. I think the students think this is the best unit I have.
I have just completed a course of study on teaching industry and mass production and will turn it in Monday, May 20, to Mr. Melvin Bell for I. E. 519. Possibly you can contact him and look this over for some ideas. Would be happy to answer any questions.
A group line-production project, at the eighth grade level, was a new method this year.
Group--scale model construction (drafting and building trades).
Mass-production projects were used for the first time--I am very satisfied with them.
Mass production in building a project.
Mass-assembly of model car kits in eighth grade for a mass production unit.